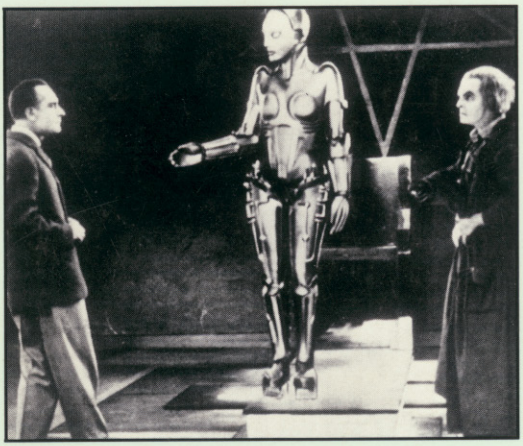
VISIT…

iris

REVUE DE THÉORIE DE L'IMAGE ET DU SON
A JOURNAL OF THEORY ON IMAGE AND SOUND

CINEMA AND COGNITIVE PSYCHOLOGY



IRIS No. 9, Spring 1989

David Bordwell

A Case for Cognitivism

Or rather, a case that the cognitive perspective can usefully guide research into various aspects of film. The literature on cognitivism in psychology, philosophy, social theory, linguistics, anthropology, and even aesthetics has become so vast that no introduction can do justice to it.[1] Indeed, nobody can keep track of it. (Already we have books on Aristotle as cognitivist [Wedin 1988] and on Robert Frost's brain [Holland 1988].) My purpose must then be narrow. I ask, first, what are some distinctive conceptual constructs and findings of the cognitive framework? Secondly, how might those help clarify some particular problems in film studies?[2]

This essay belongs to that grim genre of academic writing wherein Author A summarizes theoretical assertions made by Authors B, C, D, and so on, embellishing each with occasional commentary. The bibliography waves the reader toward those detailed arguments that, in Author A's treatment, invariably become sweeping and oversimplified (due to "limitations of time and space"). I have tried to enliven these conventions by focusing not just on doctrine but on the particular assumptions and questions characteristic of the cognitive perspective. I have also tried to avoid another cliché—the blithely sententious air that all problems are on the threshold of solution. And at the end I will attempt an innovation, one sentence that renders this exposition unlike any earlier summary I know in the film-theory literature.

As a summary that aims to introduce film scholars to a body of work, this essay is unabashedly broad. In sketching what I shall call *cognitive theory,* or the cognitive *perspective* or *frame of reference,* I will link what would usually be called "cognitive science" with a wider body of inquiry resting (or so it seems to me) on significantly similar assumptions. The breadth of my delineation may, however, incline readers to take this perspective as another one of those Big Theories of Everything that we film scholars regularly discover or assemble out of spare parts. But a Big Theory of Everything makes our task too easy; since film is, by common consent, part of Everything, the theory will directly yield an account of what cinema does (position subjects, reproduce ideology, appeal to fetishism

and scopophilia, make itself polysemous in order to create heterogeneous meanings and pleasures). We are too often in search of what Freud called a *Weltanschauung,* an "intellectual construction which solves all the problems of our existence uniformly on the basis of one overriding hypothesis, which, accordingly, leaves no question unanswered and in which everything that interests us finds its fixed place" (Freud 1933/1966, p. 622).[3] So I should say at the outset that it seems to me that no single megatheory can comprehend the diversity of cinematic phenomena; that the most fruitful research usually tackles middle-range problems, beginning neither with a theory of the human subject nor with isolated facts; and that the exposition of assumptions and implications, such as the one that follows, necessarily has a generality that cannot do justice to the middle-level research that gives the theory its real substance and diversity.

Finally, it would be wrong to see this exposition as naming Cognitivism the contender that will knock Contemporary Theory out of the ring. While I like to watch theorists argue things out, my aim is not to promote such an event here. Admittedly, I write from a position of moderate advocacy. The cognitive approach seems to me *at least* as enlightening as the theories of mind that have guided film studies in the recent past, and so I glance at some problems which most contemporary film theories have downplayed or ignored. But my main aim is exposition, not disputation. Any significant debate will be more nuanced than what follows.

The cognitive core

To get the flavor of an intellectual position, it helps to have a sense of its problem-solving program, and this in turn requires a sense of the paradigm cases on which it has focused. For psychoanalytic theory in general, the paradigm cases are the neurotic symptom (the core of the core), the bizarre dream, the bungled action, the slip of the tongue. These are the central phenomena that Freud sought to explain. Out of the explanations he built an account of human mentation that went much farther, to include all normally unexceptional behavior and much of artistic activity.[4]

On the whole, cognitive theory focuses on a different set of core phenomena. It is, in general, more concerned with normal and successful action than is the Freudian framework. What enables someone to recognize a familiar face? What happens when someone scans a list of words looking for a particular one? Why are people able to recall the gist of lengthy, even convoluted sentences but not the exact wording? Given the following piece of discourse

> Joey heard the tinkling of the ice-cream man's truck.
> He came downstairs with his wallet in his hand.

what enables the perceiver to infer that Joey wants to buy some ice cream? Why is it that in all languages terms like "dog" and "tree" are learned earlier, used more often, and remembered more quickly than words like "golden retriever" and "sycamore"? How is it that once people imagine electricity to be like a flow of water in a pipe, they are able to understand electrical concepts more clearly? Once looked at closely, multitudes of ordinary mental matters can no longer be taken for granted.

If ordinary comprehension and memory suddenly seem skillful, outstanding achievements start to look miraculous. What goes on when a chess master finds the best move? What enables Micronesian sailors to navigate hundreds of miles of open ocean without benefit of compass or sextant? How can an expert pianist play rapid sequences of notes faster than she can possibly be getting feedback from the sound of each one? Expert behavior calls out for an explanation no less than do those botched actions at the center of the Freudian problem-space.

Of course, cognitive theory also concentrates on notable failures and deficits of human mentation. Why do so many people adhere to the "gambler's fallacy"—the belief that after a long run of red on the roulette wheel black is due to show up next? How is it that even professional logicians can err when syllogistic problems are posed in terms of abstract quantities yet have no difficulty with the same syllogisms couched in homely examples? And, especially for the neurophysiological side of cognitive research, there is much to be learned from the unfortunate autistic savant who has an extraordinary memory for music or mathematical computations but who remains incapable of far more mundane tasks.

In general, cognitive theory wants to understand such human mental activities as recognition, comprehension, inference-making, interpretation, judgment, memory, and imagination. Researchers within this framework propose theories of how such processes work, and they analyze and test the theories according to canons of scientific and philosophical inquiry. More specifically, the cognitive frame of reference posits the level of mental activity as an irreducible one in explaining human social action.

Like most strands of contemporary film theory, cognitive theory rejects a behavioristic account of human action. Classic behaviorism insists that human activity can be understood without appeal to any "private" mental events. By contrast, cognitive theories hold that in order to understand human action, we must postulate such entities as perceptions, thoughts, beliefs, desires, intentions, plans, skills, and feelings. That is, there is a gap between intelligible and intentional human action and the

physiological mechanisms that execute it. According to the cognitivist tradition, this gap is filled by mentation of some sort.

So much is everyday wisdom. Cognitive theory goes on to focus on the intentional act. Here "intentional" has two distinct senses. In ordinary usage, intentionality involves action done deliberately; it suggests purposes, plans, and rule-guided behavior. This concept of intentional action played an important role in cognitivism's earliest break with behaviorism (Miller, Galanter, & Pribram 1960), and it remains in force within the rational-agent theories I shall consider further on. A more technical sense of the term derives from Husserl (Dreyfus & Hall 1982). Intentional states are directed at objects, events, and states of affairs in the world; intentional states thus have a referential "aboutness," in the sense that "The lasagna is cold" refers to the lasagna. Intentionality plays a crucial semantic role in propositional attitudes (e.g., "Tino believes that the lasagna is cold"). For cognitivism, the question is how mental activity can be considered representational, hence meaningful—that is, how it can have intentionality. (A recent treatment is Fodor 1987.)

The two senses of intentionality I have considered can be related. In describing an action as intentional (purposive, rational, or whatever) we may ascribe to it mental states that have intentionality (that is, semantic content). (See Brand 1984; Dennett 1978, 1987.) Both senses of intentionality may require a conception of mental representation, but before I consider that issue, I need to consider a methodological constraint on cognitivist theory construction.

Good naturalization

At least since Kant appealed to the faculty psychology of his day, the philosophy of mind has taken into account the findings of empirical science's investigation of the mind and brain. Conversely, one could read the history of science as turning philosophical doctrines into matters for empirical investigation. This century in particular has seen many "naturalistic" investigations of mental processes. Freudian psychoanalysis and Piaget's "genetic epistemology" are only two of many attempts to test, revise, amplify, and reconsider philosophical conceptions of subjectivity in the light of clinical or experimental research. Cognitivism stands in this tradition of "naturalizing" epistemology (Garver & Hare 1986; Goldman 1986; Kornblith 1985). Indeed, cognitivist philosophers run experiments and undertake field research (e.g., Dennett 1988).

Chief among the salient empirical data to be considered are increasingly precise findings about the biological properties of the brain and associated sensory systems. The cognitivist perspective takes seriously the fact that the brain is an energy-transformation system. This entails the as-

sumption that eventually an explanation of thought will be consistent with knowledge about how electrochemical energy is transmitted across brain cells. To take a straightforward example, Paul Churchland criticizes substance dualism (the doctrine that mental properties are produced by a nonphysical mind) on the grounds that it is incompatible with all evidence that physical changes in the brain, such as alcoholism and senile degeneration, produce predictable changes in mental states (Churchland 1988, p. 20). Similarly, the fact that the brain has evolved by selective adaptation will tend to rule out certain explanations of function, such as those which are, by Darwinian standards, either extremely inefficient or implausibly efficient. In addition, the fact that sensory mechanisms are at low levels "informationally encapsulated" and impervious to conscious awareness suggests considering the mind as a set of autonomous, highly specialized "modules" (Fodor 1983; Garfield 1987). Again, as with every physical device, the brain's resources are limited, and this entails that in any task, say recollection or problem-solving, there will be a trade-off between speed and accuracy. There is thus the possibility that the evolutionary design of this device favors rapid, probabilistic extrapolation from limited samplings of data. In such ways, cognitivism assumes that empirical science may help solve traditional philosophical problems.

Artificial intelligence furnishes the other major inspiration for cognitive theorizing. The astonishing progress in programming computers to execute many kinds of reasoning has led to reflections on whether this new machine might not offer an important analogy to human mentation (Boden 1988; Haugeland 1981, 1985; Johnson-Laird 1988).[5] The analogy moves in several directions, the most influential of which is Jerry Fodor's version of functionalism (Fodor 1975, 1981). Fodor uses the Turing-machine analogy to argue that mental representation is a matter of structurally comparable computational activities, not of embodiment in any one sort of material. That is, it just so happens that our brains are the hardware for the programs that they run. E.T. could have beliefs, plans, memories, and so on that are similar to Elliott's, even though E.T.'s are incarnated in an alien biology. Fodor exploits the computer analogy in order to take a stand on the mind–body problem.

Despite the popularity of functionalism, the computer analogy is a keenly contested issue in cognitive theorizing. Several views have emerged. Perhaps both the mind and the digital computer are subclasses of the same category of computational mechanism (Pylyshyn 1984). Perhaps the computer should be taken to model the brain rather than the mind, in which case parallel computers better capture the relevant processes (Rumelhart, McClelland, & PDP Research Group 1986). Perhaps the fact that the computer deals only with syntax, not semantics, makes it a poor basis for any cognitive theory (Searle 1984). Perhaps the chief

virtue of the computer analogy is to suggest the ways in which our reasoning fails to conform with the computer model (Gardner 1985). Not only are there *noncomputational* cognitive theories, such as George Lakoff's and Mark Johnson's "experientialist" cognitivism, but there are *computational* theories of cognition that are explicitly not *computer-based* theories, such as that propounded by Ray Jackendoff (Lakoff 1987; Johnson 1987; Jackendoff 1987). Indeed, one of the pleasures of reading this literature is the energetic and philosophically sophisticated debate about what constitutes computation.[6]

Whether inquiry is based in brain science or computer science, readers in film studies may find the noun "science" disturbing. I anticipate the charge that the cognitive perspective is "scientistic" in deriving from a suspect ideology of research. This ideology purportedly produces transcendent, crosscultural, and pan-historical truth; when in fact we know (the objection goes) that there is no such truth. This riposte is difficult to rebut in short compass. Fortunately, a recent book effectively exposes the caricatural notions of science that circulate in literary theory, and this critique would serve as well for many antiscience assumptions in film studies (Livingston 1988).

More directly, three remarks seem necessary. First, physical and natural sciences do not purport to arrive at absolute truth, only successive approximations to real processes. We may eventually discard the beliefs that molecules, DNA, and evolutionary selection are as real as anything can be, but as explanatory constructs they are notably superior to what preceded them. Cognitive theory may produce something of comparable competitive strength.

Second, insofar as one believes in the possibility of the "human sciences" at all, cognitivism is no more farfetched than any other enterprise therein. A cognitive psychology is no less plausible as, say, psychoanalysis, the scientific status of which Freud constantly proclaimed. (A good discussion is found in Sulloway 1979.) And Chomsky's cognitive linguistics has proven at least as attainable than Saussure's "science" of semiology. (See Fabb 1988 for a comparison of the two research programs.)

Finally, it is worth recalling that until lately many film theorists allied their discipline with some version of science. One need only recall the claims that were made in the 1970s on behalf of Kristeva's short-lived science of *sémanalyse* and Althusser's science of materialism.[7] In any event, as I have suggested, the project of "good naturalization"—not disguising culture as nature, but nibbling at the edges of philosophical doctrine with teeth sharpened by empirical inquiry—is at the core of many theories that film scholars still accept. Contemporary film studies can renounce some notion of science only by granting Saussurean semiotics, Freudian and Lacanian psychoanalysis, Lévi-Straussian anthropology, Jakob-

sonian linguistics, and Althusserian and post-Althusserian social theory the status of merely intriguing fictions. This is not likely to happen soon.

One reason that film scholars have been able to ignore the scientific pretensions of structuralist and poststructuralist positions is that in many, perhaps most, respects, film studies is a hermeneutic discipline. By and large it is in the business of interpreting texts (mainly, films). For this reason, theories tend to be mined for their semantic ore. If a theory is to gain institutional acceptance, it must allow an interpreter to "read" a film in a new way. Theoretical doctrines that themselves are cast in narrative form—complete with agents, struggles, journeys, and more-or-less unified resolutions—are special favorites. Hence the popularity of psychoanalytic doctrine, with its macrostories (from the *hommelette* to Oedipus and beyond) and its microstories (the case studies). Other candidates for hermeneutic application are theories that focus on particular semantic fields (e.g., power, identity, the nature of knowledge or signification) or that contain vivid and memorable metaphors (e.g., mirrors, the act of writing). If one wants a theory to serve as an allegorical key to texts, the theory's scientific aspirations can be ignored.

To this cognitivism offers a sharp challenge. One can argue that a powerful theory provides explanations rather than explications. The hermeneutic bent of film studies leads to the practice of describing texts in an informal metalanguage derived from a theoretical doctrine. But a description, even a moving or pyrotechnic one, is not an explanation. By contrast, the cognitive framework has a signal advantage. *It does not tell stories.* It is not a hermeneutic grid; it cannot be allegorized. Like all theorizing, it asks the Kantian question: Given certain properties of a phenomenon, what must be the conditions producing them? It then searches for causal, functional, or teleological explanations of those conditions.

Put aside the hermeneutic impulse, though, and you will find that some film theories do offer explanations. It is not my purpose here to decide whether the most influential theoretical formulations have provided adequate explanations of the phenomena they pick out. (See Carroll 1988 for an extended argument that they have not.) My concern is to show that the cognitivist approach, apart from its propensity for naturalistic explanation, shares with contemporary film theory a commitment to *constructivist* explanations in terms of *mental representations* functioning in a context of *social action.*

Constructivism

One could embrace all manner of "naturalistic" psychological doctrines. One could, for instance, entertain an empiricist psychology that posits mental entities as the traces of primary qualities that (somehow)

create concepts. But cognitivism characteristically presupposes *constructivism.*[8] Perceptual and cognitive activity always goes "beyond the information given" (Bruner 1973). Perception is not a passive recording of sensory stimulation; the sensory input is filtered, transformed, filled in, and compared with other inputs to build, inferentially, a consistent, stable world. To infer that Joey, coming downstairs with his wallet at the sound of the ice-cream vendor, intends to buy some ice cream requires a leap beyond what the text actually says. The judgment is a construct, which is always corrigible in the light of further information, such as a third sentence: "The bell's tinkle reminded him that he had to hide his wallet from his ice-cream-addicted sister."

There is an important link between perception and cognition in cognitivist theories. From the "New Look" psychology of the late 1950s (the first effective opponent of behaviorism) have come key concepts for articulating the relation of the two processes. "Bottom-up" processing refers to those fast, mandatory activities, usually sensory ones, that are "data-driven." "Top-down" processes are concept-driven; they are more deliberative, volitional activities like problem-solving and abstract judgment.

The crucial assumption is that both bottom-up and top-down processes manifest inference-making; both "go beyond the information given" in determinate ways. For one thing, top-down processes can shape and steer bottom-up activity. Reading a text is not simply registering letters, adding them up to make words, adding them up to make phrases, and so on. Selected chunks of text cue us to extrapolate far ahead of the words that we next encounter; we start to build a semantic structure that guides our samplings of data. (See Ellis & Beattie 1986.)

Furthermore, even the simplest perceptual activity resembles higher-level cognitive activity. Perception has built-in assumptions and hypotheses, it fills in missing information, and it draws a conclusion based on but not reducible to incoming data. Consider as an example Irwin Rock's study of vision. Rock shows that the distal stimulus, say a tree, is registered initially on the retina as a proximal stimulus. From this raw material the visual system starts to generate formal descriptions of the stimulus in terms of part/whole relations, regions, and figure/ground relations. Eventually there emerges a "preferred percept," a mental description of the tree as a three-dimensional object. The cognitivist tint of this account comes largely from Rock's insistence that perceiving anything involves description, problem-solving, and inference—all constructive processes we would normally associate with higher-level activities. The senses are engaged in an "effort after meaning" that is both structurally analogous to more abstract thought and intimately bound up with it. Hence the title of Rock's book: *The Logic of Perception* (1983). (See also Rock 1984.)

The importance of perception within the cognitive perspective should help dispel the potential objection that this view constitutes an "idealism" that ignores the existence of, say, the environment (and the text to be interpreted in it) or the human body. This is not the case. As constructivist accounts, cognitive explanations assume that perception involves a give-and-take, or feedback, between the perceiving agent and the surroundings. Furthermore, many cognitive researchers give bodily factors pride of place in explanation of mental activity, some by making bodily experience the source of organizing schemata (Johnson 1987; Lakoff 1987; Piaget 1959/1977); others by linking cognitive processes with neurophysiologically determinate ones (Patricia Churchland 1986; Paul Churchland 1988).

The interplay of top-down and bottom-up processing, along with the recognition of the "intelligence" of perceptual systems, has led most cognitivists to face the implications of the constructivist analogy. You can't build something without having (1) a purpose or goal, (2) principles of building, and (3) building materials. All three aspects of the analogy point directly toward the existence of prior components, either conceptual or physical, which operate at all stages of the process. This is a corollary of the constructivist analogy that contemporary film theory has proven unwilling to face.

I can best explain what I mean by indicating that contemporary theoretical work, in its manifestations from psychoanalysis to postmodernism, has been both strongly constructivist and strongly conventionalist. In the first place, the spectator-as-subject is assumed to partly collude in his or her subjection by contributing expectations and desires that the text requires in order to work its effects. In addition, theorists explicitly use the analogy: A film's image of woman or its portrayal of social relations is "constructed," presumably not only by the filmmakers but also by the spectator's psychic processes. Moreover, meaning is held to be constructed according to conventions; it arises from the contingencies of the given social formation. Another social formation might have other contingencies, hence other conventions, and hence other meanings. There are no prior "givens," no originary data outside society's symbolic processes.

The problem with this view is that without prior factors, construction —under the very terms of the metaphor—is impossible. Construction cannot occur without a purpose, without principles, and without materials. To deny such factors is to render the concept of construction inappropriate. And to change the analogy to that of "production" will not help, since this concept requires the same factors. The metaphor would have to change to that of *ex nihilo* creation, an unsavory alternative for a conventionalist position that wants also to be "materialist." On the other hand, contemporary theory is very reluctant to grant the existence of

prior factors, particularly those that might be biologically innate, since some positions of this sort have led to theories of biological determinism and to repressive political programs.

The dilemma is seen most acutely, I think, in contemporary film theory's treatment of learning. If the social formation has "always already" constructed a field of codes in which the individual constructs identity and meaning, the individual must somehow learn those codes. For example, if perception is coded, the newborn child must be gradually acquiring whatever perceptual routines that will guarantee, say, the illusory recognition of the self's phenomenal unity. If part of that unity is "knowing" one's place in language via a system of differentiating personal pronouns, the child must be learning those pronouns in the context of everyday interaction. So, we may ask, exactly how does this process of socialization through learning take place?

Contemporary film theory has offered no answer. Typically, some version of the Lacanian story is retold; but no explanatory account of learning social codes is offered. (See Tallis 1988 for a related argument.) It is not enough to say that some time between the ages of 6 and 18 months the child spontaneously recognizes itself in the mirror as the image of the other. Unless this is a miracle, one needs to show that certain conditions (such as maturational factors) enable this to happen. To (mis)recognize your reflection, you must already be able to pick out a figure from the ground, extract texture gradients and assign them to continuous objects (in which case one already needs a rudimentary concept of object), and so on; these conditions are required for seeing the reflection as anything at all. The theorist needs, in short, an explanation of the many perceptual skills necessary to the mirror-effect, as well as an account of how they became available to the child prior to this moment. (A generalized lack or drive will not suffice to fill in this picture; such notions can at best supply only the motor force behind the process.) Similarly, it is not enough to say that the child misrecognizes itself in language. The theorist must explain how it is that the child can "tune in" to human speech at all, pick it out from the welter of other sounds in the environment, recognize pitch and intonation contours, segment speech into sentences and phrases and words, and imbue those units with meaning.

Film theorists' silence on the subject of how symbolic conventions could be learned is all the more damaging in that every major learning theory of the century presupposes some a priori factors. The behaviorist account of conditioning posits unconditioned reflexes as the "simples" out of which more elaborate behavior is assembled. Piaget's constructivism posits sensorimotor skills as undergoing transformation through continued interaction with the world. And cognitive theories posit a rich innate mental structure that forms the basis for hypothesis-testing and revision in the course of experience. Constructivism, in one guise or an-

other, furnishes the only viable theories of learning that we have. To learn something, you must already know something else. So if your theory of cinema assumes that discursive conventions, being historically and culturally contingent, must be learned, then the theory must either devise a new theory of concept acquisition or resort to some version of constructivism, which in turn requires some commitments to prior factors.[9]

Apart from addressing the problem of learning, the constructivist account has the advantage of seeking to fit together physical, physiological, psychic, and social processes. Consider the problem of color. The fact that color categories vary across cultures ought to furnish a perfect example of the contingent nature of perception and meaning. The child brought up among Zuni Native Americans does not learn to distinguish between yellow and orange. Yet socially variable color paradigms are constructed out of data available to all normally endowed humans. As George Lakoff explains:

> Color categories do not exist objectively in the world. Wavelengths of light exist in the world, but wavelengths of light do not determine color *categories.* Color categories seem to be determined by three factors:
>
> —A neurophysiological apparatus.
>
> —A universal cognitive apparatus.
>
> —Culturally-determined choices that apply to the input of the universal cognitive apparatus.
>
> The neurophysiological apparatus involves a system of color cones in the eye and neural connections between the eye and the brain. These determine response curves whose peaks are at certain pure hues: pure red, green, blue, yellow, white, and black. Other colors—for example, orange and purple and brown—are "computed" by a universal cognitive apparatus given neurophysiological input. A cultural-specific cognitive apparatus takes this input and determines a system of color categories by shifting color centers, determining major contrasts, etc. As a result, human color categories have certain general properties. They are not uniform—they have "central" best examples, which are either neurophysiologically determined pure hues or cognitively computed focal colors that are perceived as "pure"—pure orange, brown, purple, etc. Color categories are fuzzy at their boundaries, where response curves dip and overlap. Category boundaries vary greatly from culture to culture. Central colors do not vary much, but do show some variation due to culturally determined choices of contrast. (Lakoff 1988, p. 131)

Culturally variable color schemes, that is, are constructed from the output of the cognitive processing that computes color differences, which are in turn derived from the neurophysiological output of the visual system.

The explicitly constructivist premise of cognitivism thus calls attention to the need of any naturalistic psychology to presuppose some basic

(though not raw or unmediated) data, as well as some fundamental assumptions and principles that guide human perception and thought. There is no question of "biologism" here; the physiology of the human visual system has not univocally determined how the Zuni classify colors.

Thus the issue of innateness and plasticity becomes not an absolute conceptual one but an empirical question of how circumstance may transform biologically a priori factors.[10] For example, the visual system has evolved with certain predispositions that probably had evolutionary advantages—assume a stable three-dimensional environment, be sensitive to movement, assume that light comes from above, and so on. In addition, some rudiments of deductive logic would seem necessary. One can't learn the law of noncontradiction, for the reason that without already knowing the law of noncontradiction one could never learn anything at all (Fodor 1980). Similarly, Chomsky's theory of Universal Grammar proposes principles that all learners would have to possess in order to pick up any natural language they encounter (Chomsky 1986). There are probably a great many such "contingent universals," out of which we construct collectively sanctioned behavior, and eccentric or deviant behavior as well.

A self-conscious constructivism could be a founding move for work in several areas of cinema studies. If we are committed to a naturalistic account of how films work and work on us, it would be a useful research strategy to distinguish, as Lakoff does, among neurophysiological processes (e.g., apparent motion, shape perception), universal cognitive processes (e.g., the identification of human agents on the visual track, the parsing of musical meter and rhythm), and culturally variable cognitive processes (e.g., the historically variable strategies of constructing a narrative). All are constructive processes, and most will require a degree of learning. The pioneering work of E. H. Gombrich, from *Art and Illusion* onward, has been at pains to show the complex interaction among just such processes in the visual arts (Gombrich 1960, 1973, 1982). Gombrich realized very early that a conventionalism requires a constructivism, and his ongoing assimilation of perceptual and cognitive research always granted a role to a priori factors.[11]

One advantage of adopting an explicit constructivism is that empirical research in a wide domain of specialties becomes relevant to film studies. To make things more fun, few answers can be guessed in advance. For example, beginning a story with "Once upon a time" can be seen as a parallel to the overt narrational address that initiates most classical films (not just via the credit sequence but by various self-conscious expository devices; see Bordwell, Staiger, & Thompson 1985, pp. 24–29). Such overt marking of the tale's fictional status might at first blush seem culturally specific. Yet there are comparable formulas in languages from Albanian to Serbo-Croatian, and there are functional equivalents in Navajo ("At

the time when men and animals were all the same and spoke the same language . . ."), in the Tiv tribe of Nigeria ("I can tell lies too!"), and among the Bandi of northwest Liberia ("Let's throw stories!") (Pellowski 1977). In any culture, it would seem, the story must be "framed" by conventional markers; otherwise, it may be mistaken for reportage. The self-conscious opening that frames the story may well be a pragmatic universal, like politeness formulas (Brown & Levinson 1987). The point is that we should not let a justifiable resistance to biologism block us from a rich and comprehensive explanation of how filmmaking and film viewing, like other cultural activities, build upon acquired skills and innate capacities.

Mental representations

Besides being thoroughly constructivist, the cognitive frame of reference hypothesizes that mental representations play a determinate role in organizing and executing action. Here again this squares with a central assumption of psychoanalytically inclined film theory. Freud took "word-presentations" and "thing-presentations" to be involved in mentation, while the Lacanian doctrine of the primacy of the signifer would seem also to posit a realm of mental representation.

There is much debate within cognitive theory as to the nature of mental representation. One tradition posits a "language of thought" or "mentalese," a kind of propositional syntax that underlies inference-making (see Fodor 1975). Opponents of this view hold out for more imagistic mental constructs (see Kosslyn 1980, 1983; Shepard & Cooper 1982). Some researchers believe that one sort of representation cannot be reduced to the other, and that both propositional and image-like processes function in mental activity.

Whatever the differences on this issue, cognitive researchers typically examine three aspects of mental representation. There is the semantic *content* of the representation, what it is "about"—the spatial properties ascribed to my kitchen, the proposition that a robin is a bird. There is, secondly, the *structure* of the representation—the pattern of objects perceived in space, the conceptual relation whereby the category "birds" includes the subcategory "robin." Third, there is the *processing* of mental representations, whereby top-down and bottom-up activities produce perceptual judgments, construct memories, solve problems, or draw higher-level inferences.

Processing is usually taken to involve either algorithms—determinate procedures that necessarily produce a solution—or heuristics, which are more probabilistic, strategic, and open-ended rules of thumb. A computer, which operates solely by algorithms, can play tick-tack-toe by look-

ing ahead to all move options and simply calculating the best move to make. Human players use more flexible heuristics, such as "You have a better chance of winning if you mark the center square." (Chess-playing programs cannot see ahead to all possible combinations, so their algorithms consist of rules based upon expert heuristics.)

Even as schematic an exposition as this may lay to rest another objection frequently made to the cognitive perspective, that it is opposed to concepts of representation. This is usually articulated in this way: Cognitive theory is a merely an updated version of Shannon and Weaver's "information theory," which, being sheerly a matter of quantitative measuring of a signal, is an inadequate account of representational processes. As I have indicated, however, the concept of information that most cognitive theorists use is closer to the ordinary-language notion.[12] It involves semantic content, grasped in relation to intentions, propositional attitudes, or other "semantic states." For instance, to recall the information that a robin is a bird can be considered partly a matter of having access to knowledge domains stored in memory in the form of symbols. For the cognitive theorist, the symbols belong to larger structures of knowledge or belief. As symbols, they are no less "representational" than are any other symbols in any other system. Indeed, Fodor has taken as a cognitivist motto "No computation without representation." And, I shall suggest below, cognitivists in anthropology and social theory propose intersubjective representations as well—mental maps, tacit diagrams of how gadgets work, and so forth.

Central to the cognitive perspective is the notion that mental representations are structured and processed. To illustrate the importance of these concepts, I want to consider briefly two exemplary pieces of cognitive research.

The late David Marr's theory of vision has proven an important consolidating moment in work on visual perception. The retina registers a field of 160 million points of light; what we see is a stable world of three-dimensional solids. What goes on in between? The disparity between initial stimulation and final output is so great that we might posit top-down factors, such as prior knowledge, as entering the process early on. But Marr argued that vision ought to be studied in as strictly a bottom-up manner as possible. Explicitly adopting the computer analogy, he proposed a series of stages, each with its characteristic input, algorithmic processing, and output:

1. At the earliest stage of vision, the input is a gray-level retinal image consisting only of an array of dots. The visual system, making certain assumptions about variations in light intensities (e.g., the assumption is that a change in intensities defines an edge), produces a new structure

consisting of edge segments, lines, blobs, boundaries, and the like. This output Marr calls the *primal sketch.*

2. With the primal sketch as input, the brain draws upon assumptions about orientations, distances, discontinuities in depth, and other primitives in order to recast the linear structure as a set of three-dimensional surfaces of a possible object, but one seen only from one position. This output Marr calls the *2½-D sketch,* since it lacks the true three-dimensionality of an object seen from several points of view.

3. With the 2½-D sketch as input, the brain in effect asks another structural question: Can a line drawn through the configuration yield a basic pattern of symmetry? If so, can the pattern be segmented into comparably symmetrical parts? For example, a perceptual skeleton of the human body can be constructed out of a hierarchy of axes of symmetry that yield simple geometrical solids—sphere plus cone for the head, cylinders for the trunk and arms and legs. If the 2½-D sketch can be hierarchically segmented in this way, the brain computes the *3-D model* of the object.

Only after the three-dimensional model is computed does the visual system call on higher-level processing. At this point, the model is compared with prior knowledge, memories, expectations, and other top-down factors.

Marr's theory is naturalistic. It adheres to the anatomical and physiological properties of the visual system, and it presupposes that the system's "assumptions" are designed by evolution for an environment in which they usually hold good. The theory is also constructivist, emphasizing prior materials and stages of transformation and assuming that the visual system has a purpose, the perceiving of three-dimensional objects in an environment. More to the point here, Marr seeks to show that the structural and processing aspects of mental representation can be studied somewhat independently of content; any visible object will create the retinal image that triggers the computations. Each stage constitutes a structural transformation performed by algorithms whose resources and options Marr was at pains to constrain as much as possible (Marr 1982, pp. 106–111). After all, in visual perception the transformations must be very fast, and there is not much room for elaborate sets of hypothetical alternatives.

Marr's work will doubtless be revised and perhaps superseded, but it stands as a fairly well developed specimen of the cognitive paradigm even when higher-level thought processes play little role. (Indeed, Marr's work is often discussed as the study of "visual cognition"; Pinker 1984.) A different level of mental representation is posited in Jean Matter Mandler's studies of story comprehension, but no less than Marr's they rely on notions of structure and processing (J. Mandler 1984).

The central premise here involves the concept of a *schema* (Bartlett 1932). A schema is a knowledge structure characteristic of a concept or category. For example, a buy/sell schema constitutes a basic structure: An agent that possesses something exchanges it for legal tender offered by another agent. Often a schema does not define the concept in terms of necessary and sufficient conditions. A schema is usually a set of default conditions. That is, all other things being equal, buying and selling involve the elements and relations mentioned. Moreover, schemata are embodied in prototypes, or "best examples." Our prototype of buying and selling is probably a transaction involving one person purchasing something from another with cash, check, or credit card. On the basis of the schema, as embodied in a prototype, people can apply the essential structure to a variety of differing situations. The buy/sell schema is no less pertinent when the purchaser is a company or a country, when the result of the sale is a chance to sit in a movie theatre for two hours, and when the medium is gold or an IOU. Comprehension of less prototypical cases is constructed on the basis of the components and relations characteristic of the schema.

What, asks Mandler, enables a reader or listener to understand and recall a simple story? Bottom-up processes play some role, but they can hardly account for everything. In constructing a story while following it, and in reconstructing it in memory, we work with gist—the essential events and points. We do not characteristically recall a story's surface structure (word choice, syntax, and so on). Top-down processing is therefore likely to be extracting structural essentials from the text according to familiar patterns. Mandler's experimental research indicates that schemata play an essential role in this process. (For an overview of her work, see Fayol 1985.)

As we might expect, schemata such as the buy/sell construct are fundamental to recognizing story events and segmenting stories into episodes. But more striking, Mandler and her colleagues propose prototypical schemata that are characteristic of narratives. These "canonical stories" consist of certain elements in a standard order: an initial description of time and place; a delineated episode that undergoes development; a development that consists of either characters' simple reactions that trigger immediate action or characters' complex reactions that cause a "goal path" to be initiated; and other components. This schema, with a few hierarchical branches, acts as a structured set of expectations into which the data of a given text can be factored. Such a schema can be shown to facilitate understanding and recall of a wide number of stories. Stories that do not follow the schema, such as tales lacking causal connections between episodes, are demonstrably more difficult to follow and remember. Most striking of all, when people are asked to reconstruct deviant stories, the result tends to revise the original by making it more canonical. Mandler's

most recent experiments show consistent findings across adults and children and across populations in different cultures (J. Mandler 1984, p. 50).

Mandler takes the canonical story to be a structured mental representation that is essential to understanding narrative texts. She appears to assume that such schemata function heuristically. The perceiver selects from the schema those features that seem most appropriate to the task at hand (that is, understanding the story). If the case at hand does not fit the canonical structure, then other strategies must be deployed to make sense of it.[13]

After sporadic beginnings (e.g., Pryluck 1973), scholars are starting to study cinema by means of a theory of mental representations. In an extensive series of publications, Julian Hochberg has proposed that physical movements and spatial configurations have distinctive visual features that mediate recognition. When the filmmaker seeks to represent a building as having a curved colonnade or to suggest that a person crosses a room, the onscreen cues should present the distinctive features that will prompt the spectator to make the proper perceptual inference (Hochberg 1986, pp. 44–59). This process of seeing "in the mind's eye" requires schemata for typical shapes, spatial layouts, and bodily actions. Of course, the filmmaker may wish to ambiguate the percept for various purposes, and this will require using ambivalent cues or summoning up competing schemata.

At a broader level, I have argued elsewhere that not only do narrative films utilize mental representations for their depicted events; they also draw on historically developed conventions that involve schemata and heuristics. For example, the classical Hollywood narrative is in many ways similar to Mandler's "canonical story," and it delegates to the spectator the task of assembling events into a coherent causal whole. By contrast, the tradition of "art-cinema" narration encourages the spectator to perceive ambiguities of space, time, and causality and then organize them around schemata for authorial commentary and "objective" and "subjective" realism (Bordwell 1985). The claim is that in order for films to be composed in the way they are and to produce the effects they do, some such mental representations must underpin spectatorial activity. (See also Branigan 1986; Colin 1987; and Younghouse 1985).

One could go further and ask whether more abstract interpretive activity does not also depend on such representations. In a forthcoming study, I argue that folk-psychological schemata (such as those for personhood) and certain quickly learned heuristics assist critics in ascribing implicit or symptomatic meanings to films (Bordwell in press). On this account, the critic is a problem-solver, set a task by the institution to which she or he belongs. Just as the mental lexicon and knowledge of some conventions are necessary to solve a crossword puzzle, so basic knowledge

structures and procedures enable the critic to solve the problem of interpreting a film in an acceptable way. Like all intentional action, "reading" a film ought to be mediated by mental representations.

Social action

If I have usually spoken of the cognitive perspective rather than cognitive science, it is because the latter term is more closely identified with the merging of psychology, linguistics, philosophy, and artificial intelligence. I want to show that the cognitivist framework informs a still wider range of disciplines, especially anthropology and social theory. From this angle, researchers have sought naturalistic, constructivist explanations of how social action is mediated by mental representations. I can pick out three tendencies here.

First, there is the possibility of studying how mental representations enable groups to organize cultural life. The very concepts of schema and processing involve intersubjectivity: Insofar as knowledge is a shared social resource, knowers are likely to acquire, store, and use that knowledge in similarly structured ways. The Micronesian navigational system is at once private and public, both "in the head" and part of a communal tradition.

Many sorts of cultural knowledge are organized by intersubjective schemata, scripts, or "mental models" (Johnson-Laird 1983). Anthropologist Robin Horton has proposed that all cultures share a "primary theory" that furnishes the world with a set of enduring, solid objects of middle size (say, a hundred times smaller or bigger than a human). Relations among these objects are defined by spatial contiguity, temporal successivity, and a "push-pull" conception of causality. A "secondary theory," such as a scientific or religious conception of some realm behind or beyond this tangible world, is derived by analogy from aspects of primary theory (Horton 1982). Horton is pointing out the centrality of "cultural models"—schemata that serve as the basis for understanding concrete situations. One anthropologist has studied "folk models" of the mind in various cultures, while other researchers confirm the presence of "push-pull" causality in subjects' conceptions of the behavior of electricity and of water molecules (Collins & Gentner 1987; D'Andrade 1987; Gentner & Stevens 1983).

Some collective representations may exemplify those contingent universals mentioned above. The research of Eleanor Rosch and her colleagues has suggested that various cultures represent categories in structurally similar ways. For one thing, cultural categories do not obey the necessary and sufficient conditions of formal logic: They are "fuzzy," not mutually exclusive, and notably flexible. Categories are typically rep-

resented by more or less "good" instances—*prototype* schemata. Thus in our culture, a robin is a more prototypical bird than is a parrot or a stork. Moreover, Rosch and her associates have found that if one ranks a culture's categories taxonomically, the middle-level category tends to be more "basic." Between *animal* and *retriever* stands *dog,* which functions as the schematic norm. Such basic-level categories are the most quickly identified, the first level named and understood by children, the first level to enter the lexicon of the language, and the level at which most of our knowledge is organized (Lakoff 1987, pp. 46–49). More formal and specialized categories seem to be later acquisitions.

It is likely that filmmakers and film viewers operate with common schemata and heuristics. Mandler's canonical story is a widely known schema, and film genres can function as prototype schemata (Jenkins 1986). To study the history of filmmaking is at least in part to bring to light the schemata for narrative and style employed by filmmakers and audiences (Bordwell et al. 1985). (The most influential exponent of this approach to an art is again Gombrich.) At the same time, the search for shared knowledge structures and skills ought not to ignore how different schemata and sense-making strategies can divide audiences along lines of race or class or gender or education. In research with evident pertinence to cinema viewers, "personal" gender typing is found to conform to different groups' schemata for masculine and feminine behavior (Crawford & Chaffin 1986). Similarly, the heuristics employed in making sense of art films (Bordwell 1985) are more widely shared than those elicited by, say, avant-garde films like J. J. Murphy's *Print Generation* (Peterson 1985).

Perhaps film studies itself has relied on mental models that get successively elaborated by members of the institution. Film interpretation can be seen to rely on a relatively small set of schemata and heuristics that novices learn by ostension and that experts deploy through imitation and extrapolation (Bordwell in press). It would likewise be possible to study the history of contemporary film theory as an ongoing revision of inherited schemata. One could, for example, write a history of the look in film studies—deriving from the Hegelian dialectic of master and slave; recast as Sartre's doctrine that I exist as a self-conscious subject only when I have become aware of existing as an object of the look of the other; recast again in Lacan's formulation of the other's gaze as sustaining the subject's desire; and complemented by the suggestion, emerging from the Women's Movement of the late 1960s, that women's bodies function as commodities objectified for masculine vision (as in the 1968 article "The Look Is You"; see Jaffe & Dohrn 1969). In other words, one might consider the history of film theory much as Gombrich renders the history of visual art or, more recently, some scholars have treated the history of science (Giere 1988; Miller 1986), as a process whereby vivid images or

metaphors are disseminated, recast, filled in, mapped onto diverse phenomena, and elaborated to fit specific institutional purposes. If "the history of thought is the history of its models" (Jameson 1972, p. v), the cognitive perspective suggests some ways of grasping the social dimension of those models.

The study of social cognition can display a second tendency as well, the examination of how shared schemata and heuristics mediate the performance of highly skilled tasks. Forty years ago, Karl Lashley, one of the first major dissenters from behaviorism, pointed out that skilled performance, like playing a very rapid piano piece, could not be a matter of stimulus and response, since there was no time for the pianist to hear the first note before playing the second one (Gardner 1985, pp. 12–14). Expert players seem to store the piece structurally and let the hands automatically run off integral chunks. Much the same argument can be made about typing or other highly developed skills that combine cognition with efficient motor activity. And even before Tolman, Lev Vygotsky and A. R. Luria were discovering that for preliterate peasants patterns of tool use replaced the abstract categorization favored in literate societies (Luria 1976; Vygotsky 1978).

Since Lashley's and Vygotsky's day, psychologists and anthropologists have studied skills in many cultures: Thai pottery-making, fishing in Alaska, and grocery shopping in California. Reading these findings one gets a sense of the wondrous flexibility of efficient human activity. Again and again task-specific demands shape the categories used and the heuristics employed. Southwestern blacksmiths are puzzled when the researcher wants to know what tools "belong together"; the answer is: "For what?" Smithing materials are likely to be categorized as being usable-as-is, usable-without-much-work, and scrap (Dougherty & Keller 1985). Dairy delivery staff can handle complicated arithmetical computations by a variety of heuristic strategies, including "chunking" small quantities into larger standardized units, like cases (Scribner 1986). Most shoppers solve "best-buy" problems in the supermarket by juggling at least three distinct strategies (Lave 1988). The vicissitudes of the Rat Man's desire are bizarre enough to attract anybody's interest, but there is something quietly awesome in the creative resourcefulness exhibited by ordinary people practicing a well-learned skill (Nyíri & Smith 1988).

We have no in-depth ethnographic study of professional filmmaking, although Sol Worth and John Adair produced valuable documentation of how filmmaking could be integrated into the daily life of the Navajo (Worth & Adair 1972). It would be worth following the flow of decisions made by scriptwriters, set designers, camerapersons, performers, directors, editors, and other filmmaking workers with an eye to the tacit knowledge structures and heuristics that govern their work. Similarly, it could prove enlightening to study *in situ* how children acquire the skills of

comprehending film and television programs (what questions do they ask? what schemata and heuristics are presupposed by their skills?); how "competent viewers" make sense of ordinary and unusual texts; and even how critics render a film interpretable. In the naturalistic vein, such questions can only be answered by concrete empirical work—guided, needless to say, by problems and hypotheses. The cognitive perspective can pick out such problems and propose some hypotheses.

Most broadly, we can locate a third tendency within the study of social cognition. Assume that actions performed by intentional agents are minimally rational. We make inferences about Lea's actions on the basis of the "practical syllogism": Lea intends to accomplish some purpose, she believes that certain actions will enable her to accomplish that, and the actions she takes correspond to her beliefs. With some adjustments, the same practical syllogism can guide inferences about actions taken by institutions. The regulative assumption that perceived means are adjusted to intended ends is presupposed by any coherent theory of social action. Psychoanalytic accounts, for example, employ the practical syllogism to determine the normal behavior that is disrupted by symptoms; more notably, these accounts explain symptomatic behavior as *itself* a form of adjustment of means (the symptom) to ends (temporary gratification of wishes). Minimal rationality can be seen as a set of regulative expectations by which individuals and groups make inferences about social action (Cherniak 1986).

Rigorously developed, the assumption of minimal rationality can lead to quite complex theories. The typical strategy is to start from some ideal type of "perfect rationality" and then show how collective factors necessarily constrain and reconstitute agents' preferences. (A recent synthetic example is Hollis 1987.) Although game theory has often been identified with versions of neoclassical economics, some recent Marxist sociology has sought rational-agent "microfoundations." Jon Elster has used game theory to argue that concepts of rational and irrational action are central to a scientific Marxism (Elster 1983, 1984), and John Roemer's "analytical Marxism" follows suit (Roemer 1986, 1988).

Rational-agent social theory is usually less concerned with the nature of the representations than with the assumptions or processes that eventuate in social action. For instance, some cognitive theorists seek to show that "imperfect rationality" can be explained by certain processing strategies. The research of Kahneman and Tversky suggests that errors in reasoning, such as the gambler's fallacy, often result from following heuristics that downplay statistical sampling and favor more vivid or representative cases. After a day spent paging through *Consumer Reports,* you soberly decide on the car you will buy, but you may well change your mind just by hearing the woes of one owner with a lemon (Kahneman, Slovic, & Tversky 1982; Nisbett & Ross 1980).

Rational-agent theory may inspire film scholars in a variety of ways. The practical syllogism would seem to be a basic schema that spectators use in making sense of characters' behavior (Carroll 1988, pp. 210–211). It is also possible to treat filmmakers as intentional agents in the fashion Elster and others suggest (Bordwell 1988), always remembering that this is a regulative principle and that any social theory presupposes that intentional acts have unintended consequences. Moreover, considering film scholars themselves as rational agents may shed some light on how certain interpretive traditions have been generated and perpetuated (Bordwell in press). Even film theorists can, I suspect, be shown to operate with certain corner-cutting strategies in their reasoning. For example, Kahneman and Tversky's work on heuristics may go some way to explaining the widespread intellectual appeal of psychoanalytic theory, which relies upon such vivid, available instances as Freud's case studies.

More abstractly, the rational-agent model suggests an alternative to the premise that ideology creates social subjects by marshalling unconscious processes. Noël Carroll points out that Marx considered the "dull compulsion of economic relations" a key factor in subjecting labor to the forces of capital. This suggests the possibility that the worker is faced with a forced decision: "Given the necessity of securing one's daily bread, and given the socially available means at one's disposal, it is a matter of rational choice, a simple practical syllogism, that the worker complies with capitalism" (Carroll 1988, p. 85). And insofar as Marx believes that ideology is a causal factor in social subjugation, he emphasizes that the working class has absorbed the "naturalness" of the capitalist mode of production through "education, tradition, habit" (quoted in Carroll 1988, p. 84)—factors that are amenable to an explanation in terms of culturally specific cognitive constructs. (See Arbib & Hesse 1986 for an attempt to treat ideological processes in terms of shared social schemata.)

Conclusion

My survey remains drastically incomplete. I have not considered much of the cognitive work in aesthetics and theory of the arts (Crozier & Chapman 1984; Turner 1987), particularly the rich studies of musical cognition (Dowling & Harwood 1986; Howell, Cross, & West 1985; Lerdahl & Jackendoff 1983; Solboda 1985). I have barely touched on cognitive studies of language, which may well exemplify the greatest strength of the approach. (Examples are in Bever, Carroll, & Miller 1984.) I have not tackled the issue of emotion, which seems to many to be a crucial problem for cognitive accounts. (There is a considerable literature treating the relation of cognition to emotion; see for example de Sousa 1987; G. Mandler 1984.) What I have tried to express throughout is the general

unity of this perspective and its various levels and directions of inquiry. I have thus played down many differences and disputes, and I have neglected significant critiques. (But see Coulter 1983; Cutting 1986; Dreyfus & Dreyfus 1986; Michaels & Carello 1981; Putnam 1988; Russell 1984.) Most of all I regret not being able to give a sense of the blend of rigor and humor that characterizes much writing in this tradition.

In film studies, most theoretical exposés are written as if other approaches did not exist, or at least as if predecessors failed through missing exactly the point that the favored theory is best designed to make. And most theoretical accounts exude a sweeping confidence that we are on the verge of the next Big Theory of Everything. Cognitivism can look like such a Big Theory, but it is not; move down even a notch from my broad survey and you will find that sharply distinct explanatory models crystallize around particular questions. From this level on down, one cannot find substantive tenets to which all workers tend to subscribe. One can be an in-the-head cognitive scientist when tackling problems of auditory perception and a fuzzy culturalist when considering how social rituals work. Thus one of the most vivid lessons to be learned from work in this tradition may be the reasonableness of launching distinct research enterprises that are not straightforwardly derived from a *Weltanschauung*.

Worst of all, my own sketch may have erred in evoking an upcoming string of main events in which Cognitivism is odds-on to lick current champs. So, to keep all proportions, I conclude with the sentence I promised at the outset, a proposition without parallel, as far as I know, anywhere in contemporary film theory.

All this could turn out to be wrongheaded and useless.

Most theories are. The lucky theories are a little bit right and somewhat useful here and there. While abstract doctrinal argument will be enlightening up to a point, we will not be able to assess the cognitive perspective unless we explore it, develop it, reflect on it, and test it out in a variety of middle-level investigations. Even if it proves hopelessly muddled, we will inevitably have discovered other things along the way, and we will have thought hard for a while about important and intriguing matters.

Notes

1. My sketch does not aim to replace the many excellent introductory texts, such as Cohen (1983), Stillings et al. (1987), and Gardner (1985), and Baars (1986).

2. The best short introduction to film-related work in cognitive psychology remains Brooks (1984).

3. Freud maintains that psychoanalysis is not a *Weltanschauung* but rather a science, and a rather empirical one at that: "There are no sources of knowledge of the universe other than the intellectual working-over of carefully scrutinized observations—in other words, what we call research" (Freud 1933/1966, p. 623).

4. Whether psychoanalysis should be a metapsychology is still in dispute. A challenging argument that it should not is in Edelson (1988).

5. Film scholars who might object to the mind/machine analogy ought also to resist the recurrent film-theory metaphor of the psychic "apparatus."

6. For two recent examples, see Lakoff (1988) and Fodor and Pylyshyn (1988).

7. In retrospect, perhaps such promises were simply rhetorical devices for wresting institutional authority from science-fearing humanists. Once some power had been gained, the theorists could confess, along with Barthes, to a "dream of scientificity" and return to the intuitive explication that forms the central part of training in literary criticism.

8. I do not intend to use "constructivism" in the epistemological sense that is commonly opposed to "realism." I simply mean to signal the importance of constructive inference, or inference-like procedures, in our mental activities. From the perspective I am taking here, one could be what Ronald Giere calls a "constructive realist" (Giere 1988).

9. A variant of this argument can be found in Fodor (1980).

10. See Rose, Kamin, and Lewontin (1984) for a discussion of how a constructivist and interactionist account of biological processes can confute the oversimplifications of such determinisms as pop sociobiology.

11. It seems to me that Gombrich's explicit constructivism has often been missed by commentators. Critics who wish to treat him purely as a conventionalist are puzzled by his appeal to scientific findings about perceptual processes (Krieger 1984; see Gombrich 1984 for a reply). Those who believe that he presumes an unmediated access to the real world ignore his insistence on the constructed nature of all perception (Bryson 1983). And those who want a Draconian solution to the problem posed as "nature versus convention" find him disturbingly equivocal (Mitchell 1986).

12. This is not to deny that some cognitive scientists (e.g., Dretske 1981) have sought to revise the Shannon and Weaver model to account for semantic information. See also Fodor 1986.

13. It is also possible to treat story schemata as instances of algorithmic processing. Roger Schank, who originated the idea of mental "scripts" (schemata for familiar events like having a meal in a restaurant), has sought to produce artificial-intelligence models of story comprehension (Schank & Abelson 1977; Schank & Childers 1984; see also Dyer 1983).

References

Works suitable for introductory reading are marked with an asterisk.

Arbib, M. A., & Hesse, M. (1986). *The Construction of Reality.* Cambridge: Cambridge University Press.

Baars, B. J. (1986). *The Cognitive Revolution in Psychology.* New York: Guilford.
Bartlett, F. C. (1932). *Remembering: A Study in Experimental and Social Psychology.* Cambridge: Cambridge University Press.
Bever, T. G., Carroll, J. M., & Miller, L. A., eds. (1984). *Talking Minds: The Study of Language in the Cognitive Sciences.* Cambridge: M.I.T. Press.
*Boden, M. A. (1988). *Computer Models of Mind: Computational Approaches in Theoretical Psychology.* Cambridge: Cambridge University Press.
Bordwell, D. (1985). *Narration in the Fiction Film.* Madison: University of Wisconsin Press.
Bordwell, D. (1988). *Ozu and the Poetics of Cinema.* Princeton: Princeton University Press.
Bordwell, D. (in press). *Making Meaning: Inference and Rhetoric in the Interpretation of Cinema.* Cambridge: Harvard University Press.
Bordwell, D., Staiger, J., & Thompson, K. (1985). *The Classical Hollywood Cinema: Film Style and Mode of Production to 1960.* New York: Columbia University Press.
Brand, M. (1984). *Intending and Acting: Toward a Naturalized Action Theory.* Cambridge: M.I.T. Press.
Branigan, E. (1986). "Here is a picture of no revolver!": The negation of images, and methods for analyzing the structure of pictorial statements. *Wide Angle,* 8(3–4), pp. 8–17.
Brooks, V. (1984). Film, perception, and cognitive psychology. *Millennium Film Journal,* 14/15, 105–126.
Brown, P., & Levinson, S. C. (1987). *Politeness: Some Universals in Language Usage.* Cambridge: Cambridge University Press.
Bruner, J. (1973). *Beyond the Information Given: Studies in the Psychology of Knowing.* New York: Norton.
Bryson, N. (1983). *Vision and Painting: The Logic of the Gaze.* New Haven, CT: Yale University Press.
Carroll, N. 1988. *Mystifying Movies: Fads and Fallacies of Contemporary Film Theory.* New York: Columbia University Press.
Cherniak, C. (1986). *Minimal Rationality.* Cambridge: M.I.T. Press.
Chomsky, N. (1986). *Knowledge of Language: Its Nature, Origin and Use.* New York: Praeger.
*Churchland, P. M. (1988). *Matter and Consciousness: A Contemporary Introduction to the Philosophy of Mind* (rev. ed.). Cambridge: M.I.T. Press.
Churchland, P. S. (1986). *Neurophilosophy: Toward a Unified Science of the Mind/Brain.* Cambridge: M.I.T. Press.
*Cohen, G. (1983). *The Psychology of Cognition.* New York: Academic Press.
Colin, M. (1987). Comprendre l'évenément sportif à la télévision: L'exemple de la course cycliste. *Mana,* 7, pp. 97–123.
Collins, A., & Gentner, D. (1987). How people construct mental models. In *Cultural Models in Language and Thought* (D. Holland & N. Quinn, Eds., pp. 243–265). Cambridge: Cambridge University Press.
Coulter, J. (1983). *Rethinking Cognitive Theory.* New York: St. Martins Press.
Crawford, M., & Chaffin, R. (1986). The reader's construction of meaning: Cognitive research on gender and comprehension. In *Gender and Reading: Es-*

says on Readers, Texts, and Contexts (E. A. Flynn & P. P. Schweickart, Eds.), pp. 3–30. Baltimore: Johns Hopkins University Press.
Crozier, W. R., & Chapman, A. J. (1984). *Cognitive Processes in the Perception of Art.* Amsterdam: North-Holland.
Cutting, J. E. (1986). *Perception with an Eye for Motion.* Cambridge: M.I.T. Press.
D'Andrade, R. (1987). A folk model of the mind. In *Cultural Models in Language and Thought* (D. Holland & N. Quinn, Eds.), pp. 112–148. Cambridge: Cambridge University Press.
de Sousa, R. (1987). *The Rationality of Emotion.* Cambridge: M.I.T. Press.
Dennett, D. C. (1978). *Brainstorms: Philosophical Essays on Mind and Psychology.* Cambridge: M.I.T. Press.
Dennett, D. C. (1987). *The Intentional Stance.* Cambridge: M.I.T. Press.
Dennett, D. C. (1988). Out of the armchair and into the field. *Poetics Today,* 9(1), pp. 205–221.
Dougherty, J. W. D., & Keller, C. M. (1985). Taskonomy: A practical approach to knowledge structures. In *Directions in Cognitive Anthropology* (J. W. D. Dougherty, Ed.), pp. 161–174. Urbana: University of Illinois Press.
Dowling, W. J., & Harwood, D. L. (1986). *Music Cognition.* New York: Academic Press.
Dretske, F. I. (1981). *Knowledge and the Flow of Information.* Cambridge: M.I.T. Press.
Dreyfus, H. L., & Dreyfus, S. E. (1986). *Mind over Machine: The Power of Human Intuition and Expertise in the Era of the Computer.* New York: The Free Press.
Dreyfus, H. & Hall, H., Eds. (1982). *Husserl, Intentionality, and Cognitive Science.* Cambridge: M.I.T. Press.
Dyer, M. G. (1983). *In-Depth Understanding: A Computer Model of Integrated Processing for Narrative Comprehension.* Cambridge: M.I.T. Press.
Edelson, M. (1988). *Psychoanalysis: A Theory in Crisis.* Chicago: University of Chicago Press.
Ellis, A., & Beattie, G. (1986). *The Psychology of Language and Communication.* New York: Guilford.
Elster, J. (1983). *Sour Grapes: Studies in the Subversion of Rationality.* Cambridge: Cambridge University Press.
Elster, J. (1984). *Ulysses and the Sirens: Studies in Rationality and Irrationality.* Cambridge: Cambridge University Press.
Fabb, N. (1988). Saussure and literary theory: From the perspective of linguistics. *Critical Quarterly,* 30(2), pp. 58–72.
Fayol, M. (1985). *Le Récit et sa construction: Une approche de psychologie cognitive.* Neuchatel: Delachaux and Niestlé.
Fodor, J. A. (1975). *The Language of Thought.* Cambridge: Harvard University Press.
Fodor, J. A. (1980). Fixation of belief and concept acquisition. In *Language and Learning: The Debate between Jean Piaget and Noam Chomsky* (M. Piattelli-Palmarini, Ed.), pp. 142–149. Cambridge: Harvard University Press.
Fodor, J. A. (1981). *Representations: Philosophical Essays on the Foundations of Cognitive Science.* Cambridge: M.I.T. Press.
Fodor, J. A. (1983). *The Modularity of Mind.* Cambridge: M.I.T. Press.

Fodor, J. A. (1986). Information and association. In *The Representation of Knowledge and Belief* (M. Brand & R. L. Harnish, Eds.), pp. 80–100. Tucson: University of Arizona Press.
Fodor, J. A. (1987). *Psychosemantics: The Problem of Meaning in the Philosophy of Mind.* Cambridge: M.I.T. Press.
Fodor, J. A., & Pylyshyn, Z. W. (1988). Connectionism and cognitive architecture: A critical analysis. In *Connections and Symbols* (S. Pinker & J. Mehler, Eds.), pp. 3–71. Cambridge: M.I.T. Press.
Freud, S. (1966). The question of a *Weltanschauung.* In *The Complete Introductory Lectures in Psychoanalysis* (J. Strachey, Transl. and Ed.), pp. 622–646. New York: Norton. (Originally published in 1933)
*Gardner, H. (1985). *The Mind's New Science: A History of the Cognitive Revolution.* New York: Basic Books.
Garfield, J. L. (1987). *Modularity in Knowledge Representation and Natural Language Processing.* Cambridge: M.I.T. Press.
Garver, N., & Hare, P. H., Eds. (1986). *Naturalism and Rationality.* Buffalo, NY: Prometheus.
Gentner, D., & Stevens, A. L., Eds. (1983). *Mental Models.* Hillsdale, NJ: Erlbaum.
Giere, R. N. (1988). *Explaining Science: A Cognitive Approach.* Chicago: University of Chicago Press.
Goldman, A. I. (1986). *Epistemology and Cognition.* Cambridge: Harvard University Press.
Gombrich, E. H. (1960). *Art and Illusion: A Study in the Psychology of Pictorial Representation.* Princeton: Princeton University Press.
Gombrich, E. H. (1973). Illusion and art. In *Illusion in Nature and Art* (R. L. Gregory & E. H. Gombrich, Eds.), pp. 193–243. London: Duckworth.
Gombrich, E. H. (1982). *The Image and the Eye: Further Studies in the Psychology of Pictorial Representation.* Ithaca: Cornell University Press.
Gombrich, E. H. (1984). Representation and misrepresentation. *Critical Inquiry,* 11(2), pp. 195–201.
Haugeland, J., Ed. (1981). *Mind Design: Philosophy, Psychology, Artificial Intelligence.* Cambridge: M.I.T. Press.
*Haugeland, J. (1985). *Artificial Intelligence: The Very Idea.* Cambridge: M.I.T. Press.
Hochberg, J. (1986). Representation of motion and space in video and cinematic displays. In *Handbook of Perception and Human Performance* (K. R. Boff, L. Kaufman, & J. P. Thomas, Eds.), Vol. 1: *Sensory Processes and Perception;* chap. 22, pp. 44–59. New York: Wiley.
Holland, N. (1988). *The Brain of Robert Frost: A Cognitive Approach to Literature.* New York: Routledge.
Hollis, M. (1987). *The Cunning of Reason.* Cambridge: Cambridge University Press.
Horton, R. (1982). Tradition and modernity revisited. In *Rationality and Relativism* (M. Hollis & S. Lukes, Eds.), pp. 201–260. Cambridge: M.I.T. Press.
Howell, P., Cross, I., & West, R., Eds. (1985). *Musical Structure and Cognition.* New York: Academic Press.
*Jackendoff, R. (1987). *Consciousness and the Computational Mind.* Cambridge: M.I.T. Press.

Jaffe, N., & Dohrn, B. (1969). The look is you. In *The New Left: A Documentary History* (Massimo Teodori, Ed.), pp. 355–358. Indianapolis: Bobbs Merrill.
Jameson, F. (1972). *The Prison-House of Language: A Critical Account of Structuralism and Russian Formalism.* Princeton: Princeton University Press.
Jenkins, H. (1986). The amazing push me/pull you text: A cognitive model of comic film narrative. *Wide Angle,* 8(3–4), pp. 35–44.
*Johnson, M. (1987). *The Body in the Mind: The Bodily Basis of Meaning, Imagination, and Reason.* Chicago: University of Chicago Press.
Johnson-Laird, P. N. (1983). *Mental Models: Towards a Cognitive Science of Language, Inference, and Consciousness.* Cambridge: Cambridge University Press.
*Johnson-Laird, P. N. (1988). *The Computer and the Mind: An Introduction to Cognitive Science.* Cambridge: Harvard University Press.
Kahneman, D., Slovic, P., & Tversky, A., Eds. (1982). *Judgment under Uncertainty: Heuristics and Biases.* Cambridge: Cambridge University Press.
Kornblith, H., Ed. (1985). *Naturalizing Epistemology.* Cambridge: M.I.T. Press.
Kosslyn, S. M. (1980). *Image and Mind.* Harvard: Harvard University Press.
*Kosslyn, S. M. (1983). *Ghosts in the Mind's Machine: Creating and Using Images in the Brain.* New York: Norton.
Krieger, M. (1984). The ambiguities of representation and illusion: An E. H. Gombrich retrospective. *Critical Inquiry,* 11(2), pp. 181–184.
Lakoff, G. (1987). *Women, Fire, and Dangerous Things: What Categories Reveal about the Mind.* Chicago: University of Chicago Press.
*Lakoff, G. (1988). Cognitive semantics. In *Meaning and Mental Representations* (U. Eco, M. Santambrogio, & P. Violi, Eds.), pp. 119–154. Bloomington: Indiana University Press.
Lave, J. (1988). *Cognition in Practice: Mind, Mathematics and Culture in Everyday Life.* Cambridge: Cambridge University Press.
Lerdahl, F., & Jackendoff, R. (1983). *A Generative Theory of Tonal Music.* Cambridge: M.I.T. Press.
Livingston, P. (1988). *Literary Knowledge: Humanistic Inquiry and the Philosophy of Science.* Ithaca, NY: Cornell University Press.
Luria, A. R. (1976). *Cognitive Development: Its Cultural and Social Foundations.* Cambridge: Harvard University Press.
Mandler, G. (1984). *Mind and Body: Psychology of Emotion and Stress.* New York: Norton.
Mandler, J. M. (1984). *Stories, Scripts, and Scenes: Aspects of Schema Theory.* Hillsdale, NJ: Erlbaum.
Marr, D. (1982). *Vision.* San Francisco: Freeman.
Michaels, C. F., & Carello, C. (1981). *Direct Perception.* Englewood Cliffs, NJ: Prentice-Hall.
Miller, A. I. (1986). *Imagery in Scientific Thought: Creating 20th-Century Physics.* Cambridge: M.I.T. Press.
Miller, G., Galanter, E., & Pribram, K. (1960). *Plans and the Structure of Behavior.* New York: Holt, Rinehart, & Winston.
Mitchell, W. J. T. (1986). *Iconology: Image, Text, Ideology.* Chicago: University of Chicago Press.

Nisbett, R., & Ross, L. (1980). *Human Inference: Stategies and Shortcomings of Social Judgment.* Englewood Cliffs, NJ: Prentice-Hall.
Nyíri, J. C., & Smith, B. (1988). *Practical Knowledge: Outlines of a Theory of Traditions and Skills.* London: Croom Helm.
Pellowski, A. (1977). *The World of Storytelling.* New York: Bowker.
Peterson, J. (1985). The artful mathematicians of the avant-garde. *Wide Angle,* 7(3), pp. 14–23.
Piaget, J. (1977). The early growth of logic in the child: Classification and seriation. In *The Essential Piaget: An Interpretive Reference and Guide* (H. E. Gruber & J. J. Vonèche, Eds.), pp. 359–393. New York: Basic Books. (Originally published in 1959.)
Pinker, S., Ed. (1984). *Visual Cognition.* Cambridge: M.I.T. Press.
Pryluck, C. (1973). *Sources of Meaning in Motion Pictures and Television.* Ph.D. dissertation, Dept. of Speech and Dramatic Art, University of Iowa.
Putnam, H. (1988). *Representation and Reality.* Cambridge: M.I.T. Press.
Pylyshyn, Z. W. (1984). *Computation and Cognition: Toward a Foundation for Cognitive Science.* Cambridge: M.I.T. Press.
Rock, I. (1983). *The Logic of Perception.* Cambridge: M.I.T. Press.
Rock, I. (1984). *Perception.* New York: Scientific American Library.
Roemer, J., Ed. (1986). *Analytical Marxism.* Cambridge: Cambridge University Press.
Roemer, J. E. (1988). *Free to Lose: An Introduction to Marxist Economic Philosophy.* Cambridge: Cambridge University Press.
Rose, S., Kamin, L. J., & Lewontin, R. C. (1984). *Not in Our Genes: Biology, Ideology and Human Nature.* Harmondsworth, England: Penguin.
Rumelhart, D. E., McClelland, J. L., & the PDP Research Group. (1986). *Parallel Distributed Processing: Explorations in the Microstructure of Cognition.* Vol. 1: Foundations. Cambridge: M.I.T. Press.
Russell, J. (1984). *Explaining Mental Life: Some Philosophical Issues in Psychology.* London: Macmillan.
Schank, R. C., & Abelson, R. (1977). *Scripts, Plans, Goals, and Understanding: An Inquiry into Human Knowledge Structures.* Hillsdale, NJ: Erlbaum.
*Schank, R. C., & Childers, P. (1984). *The Cognitive Computer: On Language, Learning, and Artificial Intelligence.* Reading, MA: Addison Wesley.
Scribner, S. (1986). Thinking in action: Some characteristics of practical thought. In *Practical Intelligence: Nature and Origins of Competence in the Everyday World* (R. J. Sternberg & R. K. Wagner, Eds.), pp. 13–30. Cambridge: Cambridge University Press.
Searle, J. (1984). *Mind, Brains and Science.* London: British Broadcasting Corp.
Shepard, R. N., & Cooper, L. A. (1982). *Mental Images and Their Transformations.* Cambridge: M.I.T. Press.
Sloboda, J. A. (1985). *The Musical Mind: The Cognitive Psychology of Music.* Oxford, England: Clarendon Press.
*Stillings, N. A., Feinstein, M. H., Garfield, J. L., Rissland, E. L., Rosenbaum, D. A., Weisler, S. E., & Baker-Ward, L. (1987). *Cognitive Science: An Introduction.* Cambridge: M.I.T. Press.
Sulloway, F. J. (1979). *Freud: Biologist of the Mind.* London: Fontana.

Tallis, R. (1988). *Not Saussure: A Critique of Post-Saussurean Literary Theory.* London: Macmillan.
Turner, M. (1987). *Death Is the Mother of Beauty: Mind, Metaphor, Criticism.* Chicago: University of Chicago Press.
Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Cambridge: Harvard University Press.
Wedin, M. V. (1988). *Mind and Imagination in Aristotle.* New Haven, CT: Yale University Press.
Worth, S., & Adair, J. (1972). *Through Navajo Eyes: An Exploration in Film Communication and Anthropology.* Bloomington: Indiana University Press.
Younghouse, P. (1985). *Some Postulates About Film Comprehension as a Cognitive Process.* Unpublished manuscript.

Cet essai rend compte des principales suppositions et des principaux arguments de l'analyse cognitive en psychologie, philosophie, anthropologie et sociologie. Le système cognitif est fondamentalement naturaliste et constructiviste. Elle suppose des représentations mentales qui fonctionnent dans un contexte d'action sociale. Cet essai passe en revue la recherche sur la perception ("d'en haut" contre "d'en bas"), l'inférence (à travers les concepts d'algorithme, de schémas, et d'heuristique), la solution des problèmes, le jugement, la compréhension narrative, la compétence experte, et la détermination rationnelle. L'essai suggère que l'étude du cinéma pourrait bénéficier de plusieurs aspects du cognitivisme, surtout quand elle cherche à expliquer plutôt qu'à interpréter. Sont traités aussi divers aspects de style et de narration cinématographique, ainsi que les traditions théorique et critique en cinéma.